Research Article

Innovative Research on the Cultivation System of the Core Competence of College Students[*]

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Abstract

At present, the cultivation of college students in colleges and universities mostly focuses on general education while emphasis is not given to the cultivation of the core competence of college students. Also, there are few innovation researches in the core competence training system. In order to solve this problem, this paper starts from the emphasis on the cultivation of core competence and innovatively proposes a outcome-based curriculum teaching system for the construction of college students' core competence cultivation system. The outcome-based curriculum teaching system adopts the method of teacher-student interview and quantitative analysis to promote the cultivation of college students' core competence and analyzes and discusses the influence of innovative curriculum teaching system on the improvement of college students' core competence. The practice results show that the outcome-based curriculum teaching system can comprehensively enhance students' core competence, especially in terms of their global vision, critical thinking, innovation ability, social and state responsibility, lifelong learning, entrepreneurship and leadership coordination.

Keywords

College Education • Core Competence of College Students • Cultivation System • Result Orientation

At present, the teaching and cultivation programs of colleges and universities for college students mostly focus on the imparting of general knowledge such as science, humanities, philosophy, literature and engineering (Wu, Wang, Ying & Ming, 2014), but the cultivation of the core competence of college students has not received enough emphasis (Kahol, Huston, Hamann & Ferrara, 2011). Without incorporating core competence programs into college teaching programs (Shankararaman & Ducrot, 2016), it is impossible for college students to form and develop their core competence, such as global vision, critical thinking, innovative ability, social and state responsibility, lifelong learning, entrepreneurship and leadership coordination (Takahashi, 2015; Fater, 2013) At present, this situation must be changed and it is necessary to pay full attention to the cultivation of the core competence of college students.

In recent years, some scholars have shown that outcome-based teaching methods can significantly improve college students' academic performance and cultivate their core competence (Monn et al., 2013; Nelson & Smock, 2010). The general definition of outcome-based teaching methods is the teaching with the goal of knowledge, ability and direction. The direction is considered to be the emotional dimension and attitude dimension of learning (Barman & Bolander, 2014). However, some scholars are skeptical and believe that it is difficult to achieve the evaluation of outcome-based teaching. Although standardized tests and test methods are highly effective and reliable, they may not be suitable for the evaluation of outcome-based teaching evaluation (Jochemsenvan, Dijk & Waard, 2011); some scholars and teachers believe that the complexity of teaching reform, the time spent and the requirements for teachers' energy are neglected (Zhang, Berger, Malhotra & Kales, 2012). In order to solve this problem, this paper deeply studies the outcome-based innovative teaching system and applies the research to teaching practice to analyze its promotion effect on the cultivation of college students' core competence.

In order to study the promotion effect of outcome-based education (OBE) on the cultivation of core competence, this paper establishes a research group at Polytechnic University to conduct theoretical research, practical application and impact analysis on the cultivation of the core competence of college students based on outcome-based innovative teaching. The theoretical research is discussed from three aspects: research structure, research methods and interview content. Then, the theoretical research is applied to the teaching practice of the surveyed departments of Polytechnic University and the survey data is obtained; finally, from the interview qualitative analysis and statistical quantitative analysis, the positive impact of outcome-based innovative teaching on the cultivation of core competence of college students is obtained, especially the global vision, innovation ability, social and state responsibility, entrepreneurship and leadership coordination of students.

Research Architecture of the Outcome-Based Innovative Teaching System on the Core Competence Cultivation

Research Architecture

The research architecture proposed in this paper is shown in the following Figure. The outcome-based innovative teaching system affects the curriculum revision, teaching practice, evaluation system and faculty

development activities of Polytechnic University and these changes in the teaching system will bring about changes in the cultivation results of students' core competence.

Research Methods

This paper uses the semi-structured qualitative interview research method to interview department leaders and teachers to understand the changes in curriculum content. There are four departments under investigation, namely BRE (Building and Real Estate); BSE (Building Services Engineering); CSE (Civil and Structural Engineering); LSGI (Land Surveying and Geo-Informatics). The number of interviewees in above departments is shown in Table 1.
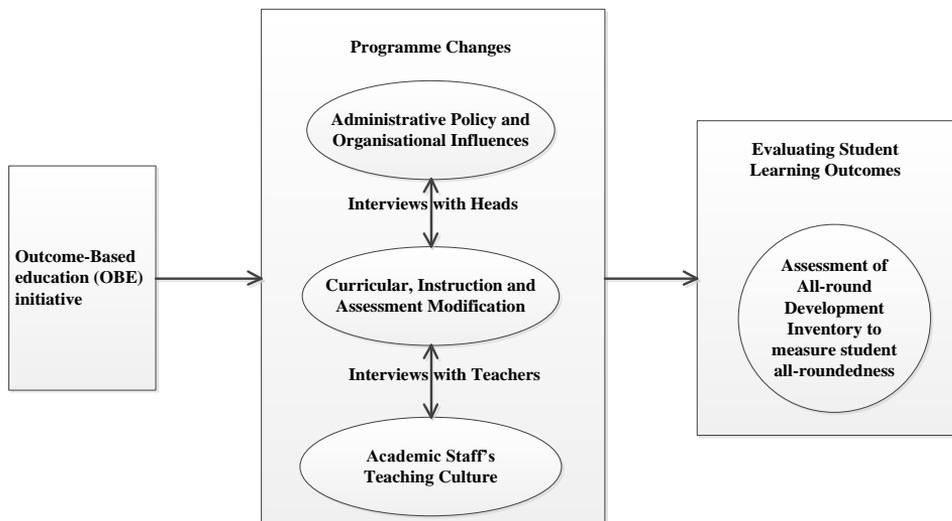

Figure 1. Conceptual Framework of the OBE Study.

Table 1
Statistics of Interviewees from Departments

interviewee	BRE	BSE	CSE	LSGI	Total
Head of department	1	1	2	1	5
teacher	5	3	3	3	14

Interviewees are free to express their opinions based on a series of open questions and the focus of the interview is to collect qualitative information that satisfies two main research purposes. First, the information collected is conducive to clarifying the implementation of outcome-based innovation teaching in each department; second, in the subsequent research on the impact of the outcome-based innovation teaching on students' core competence, the data collected can be used to verify whether it is based on an effective alternation mode.

Interview Content

The research team prepare two sets of interview questions: first, the interview of four independent working groups to know their corresponding strategies and methods in the implementation of outcome-based innovative teaching; second, consulting the opinions of teachers on the outcome-based innovative teaching system and their experience and recommendations for teaching practice and assessment reform. All interviews are recorded and transcribed into text and data formats to facilitate the analysis. In order to obtain the real information of t interviewees and avoid unnecessary disputes, all interviewees are anonymous.

Research Practice of Result-Based Innovative Teaching System

Due to the protection of student information and data, the research team is unable to obtain the academic performance of students to measure the impact of outcome-based innovative teaching on students' core competence; however, the assessment survey of comprehensive development formulated by the College of Student Affairs and Education Development Center of Polytechnic University is also an effective measure of the core competence of students. This survey report has proven to be fairly reliable, effective and sensitive to measuring the core competence of college students. The report requires students to rate the skills and behavior of 14 core competence areas on a 7-point scale, as shown in the Table below.

Table 2
Areas of Students Core Competencies

Core Competency	Core Competency
1. Communication	8. Healthy Lifestyle
2. Creative Thinking	9. Interpersonal Effectiveness
3. Critical Thinking	10. Leadership
4. Cultural Appreciation	11. Life-long Learning
5. Emotional Intelligence & Wellness	12. Problem Solving
6. Entrepreneurship	13. Social & National Responsibility
7. Global Outlook	14. Teamwork

The first set of survey data of the evaluation of comprehensive development was collected at the end of the second semester of the 2014/15 school year. Of the 1055 college students surveyed, 667 completed and returned the questionnaire, with a response rate of 63%. The following two Tables record the distribution of responses.

Table 3
Data Collected by the End Second Semester of 2014/15-Distribution by Gender and Level of Study

Total	Gender		level of study		
	male	female	Year-one 2014/17 (with 1-year OBE)	Year-two 2013/16 (with no OBE)	Year-three 2012/15 (with no OBE)
667	402(63%)	235(37%)	219(33%)	211(32%)	237(35%)

Table 4
Data Collected by the End Second Semester of 2014/15 -Distribution by Department

Total	BRE	BSE	CSE	LSGI
667	283(42%)	123(19%)	186(28%)	186(11%)

The second set of data was collected at the end of the second semester of the 2015/16 school year. Of the 745 college students surveyed, 489 completed and returned the questionnaire, with a response rate of 66%. The following two Tables record the distribution of responses.

Table 5
Data collected by the end second semester of 2015/16 -distribution by gender and level of study

Total	Gender		Level of study	
	male	female	Year-two 2014/09 (with no OBE)	Year-three 2013/16 (with no OBE)
489	289(63%)	171(37%)	300(61%)	189(39%)

Table 6
Data Collected by the End Second Semester of 2015/16 -Distribution by Department

Total	BRE	BSE	CSE	LSGI
489	221(45%)	67(14%)	144(29%)	57(12%)

Analysis of the Impact of Outcome-Based Innovative Teaching System on the Cultivation of Core Competence

Interview Qualitative Analysis

The data collected in the above interviews shows that the outcome-based innovative teaching has been implemented in various departments from the management point of view and the teaching plan and organizational practice have been changed to cope with the innovation curriculum. Each faculty has established a specialized agency to initiate and monitor the necessary changes in curriculum revision. Teachers from different majors and professionals in the industry are involved to ensure that the revision is consistent with the concept of innovative teaching, outcome-based teaching. In the curriculum construction, each department focuses on the expected learning outcome of students.

In order to adapt to this innovative teaching, faculty leaders need the support from teachers. Therefore, each department clearly explains the reason for implementing the outcome-based innovative teaching, share good practical experience of teachers, repeatedly emphasize the necessity of teaching reform and investing additional resources in the training of teachers. Academic peers are specifically selected to review exams and papers developed by their colleagues and department leaders appreciate the interactive process in peer review.

The department leaders find that teachers have no difficulty in dealing with the outcome-based innovative teaching. They believe that their department has achieved the outcome-based innovative teaching courses. They believe that there is no problem in convincing colleagues to implement the outcome-based innovative teaching and there is no evidence of any boycott of the implementation of the new curriculum. They are very certain that teachers have no problems in dealing with the technology of the new curriculum.

The teaching philosophy of teachers has also changed. They have noted an improvement in the comprehensive development atmosphere within the university. The curriculum design has changed from a

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specialized profession to a comprehensive development, supporting the general and professional development of students. In order to show their cooperative attitude, teachers try to change the activities and evaluation of teaching and learning to meet the needs of outcome-based innovative teaching. All teaching activities are based on expected learning outcomes and the evaluation of students is changed to a standard reference model. The score is given based on a set of criteria. In addition, the implementation of outcome-based innovative teaching has also led to a shift in the focus of teachers and they are more concerned about class management and deep learning of students. In terms of attitude, most teachers are positive about the implementation of outcome-based innovative teaching. They have noted that the curriculum design is an activity in which teachers match the academic outcome to the curriculum outcome and combine learning, teaching, and evaluation activities with the expected learning outcome of students.

Teachers have found the positive impact of outcome-based innovative teaching, such as higher student attendance, positive student feedback and better students' feedback and motivation. From the tone of the interviewed teachers, the team has found that teachers are excited about the research results, though they have shown concern about the long-term sustainable implementation due to the need for much more efforts.

Although most teachers are in favour of the outcome-based innovative teaching, they also face some problems. Some teachers believe that the evaluation mechanism based on the existing credit system cannot effectively evaluate the effectiveness of learning and teaching methods based on outcome-based innovative teaching; some teachers believe that students might give lower evaluation for teachers when teaching mode is transformed the outcome-based innovative teaching, leading students, which brings pressure to teachers; some teachers believe that students do not adapt to the management mode of the new curriculum and the innovation of teaching methods cannot be fully supported by all students.

Statistical Quantitative Analysis

The statistical method is used for the analysis. When comparing data groups 2012/15, 2013/16 and 2014/17, the multivariate analysis of variance is performed on the data collected in the second semester of 2014/15 to test whether there is significant difference in the evaluation results of students with different learning levels. The results of multivariate analysis of variance show that the effect of receiving the outcome-based innovative teaching is significant, Wilks'L=0.91, $F(28,1098)=1.99$, $p=0.002$. A more in-depth pairwise comparison shows that the score of lifelong learning, entrepreneurship and creative thinking in 2012/15 (the 3rd year of not receiving the outcome-based innovative teaching) is significantly higher than that in 2014/17 (the first year of receiving the outcome-based innovation teaching) and that in 2013/16 (the 2nd year of receiving the outcome-based innovative teaching). In the global outlook, the core of students is also higher than in 2013/16 (the 2nd year of not receiving the outcome-based innovation teaching). There is no interaction between the time of leaning and the gender, which shows that there is no significant difference in the trend and extent of the above impact among two genders and four departments.

The last year of the two data groups is further compare of, namely 2012/15 and 2013/16. 189 questionnaires are collected from the third-grade students (receiving the outcome-based innovative teaching in the final year

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of the 2013/16 school year) in the second semester of the 2015/16 school year and then the results are compared with 213 questionnaires collected from the data group of 2012/2015 school year of the second semester of the 2014/15 school year (not receiving formal outcome-based innovative teaching). The response results of these two groups are observed by multivariate analysis of variance. The results of the multivariate equation analysis show that the difference between the two groups is significant, Wilks'L=0.94, F (14,373) = 1.74, p<0.05. A more in-depth pairwise comparison shows that the self-scoring of lifelong learning, entrepreneurship, creative thinking and teamwork in the 2012/15 school year is significantly higher than that in the 2013/16 school year. There is no interaction between the time of leaning and the gender, which shows that there is no significant difference in the trend and extent of the above impact among two genders and four departments.

There is significant gender difference in two groups of third-grade students, Wilks'L=0.89, F (14,341) = 3.04, p<0.001. A more in-depth pairwise comparison shows that females score significantly higher in cultural appreciation, teamwork, leadership, communication skills, social and national responsibility, global vision, lifelong learning, and interpersonal effectiveness than males.

Finally, the team tests the impact of the time of learning on these two groups, namely the second year (two years of formal outcome-based innovation teaching in 2014/17) and the third year (receiving formal outcome-based innovation in 2013/16). Of the 489 questionnaires collected during the second semester of the 2015/16 school year, 211 are in August, 2014 (from the 2014/17 data group) and the second semester of the 2014/15 school year (from the 2013/16 data group). The formal outcome-based innovative teaching has not been conducted at that time. The survey data is compared at these two time points and the repeated multivariate analysis of the two-way subjects is used to check whether there is any significant change. More controlling factors of individual differences are added when testing relatively stable personal factors, such as talent, personality, and learning initiative in these two time points. The interviewees are compared with themselves rather than other group of people, F(1,214) = 2.787, p<0.10. The results of the analysis show that there is no interaction between the time of learning and data, indicating that there is no significant difference in the effect of time of learning and the trend in these two groups.

Conclusion

This paper studies the promotion effect of by outcome-based education (OBE) for the cultivation of core competence, and establishes a research group at Polytechnic University to conduct the theoretical research, practical application and impact analysis on the cultivation of college students' core competence based on the outcome-based innovative teaching. The theoretical research gives the research structure, research method and interview content and the theoretical research is applied to practice, obtaining the survey data. Finally, from the perspective of interview qualitative analysis and statistical quantitative analysis, the positive impact of the outcome-based innovative teaching on the cultivation of college students' core competence is obtained, especially in terms of the core competence of global vision, innovation, social and state responsibility, entrepreneurship and leadership coordination.

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